RESTRICTED CIRCULATION

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AGRICULTURAL MEMORANDUM NO 733

Correlation between monthly means of sunshine and radiation on a horizontal surface: Agroclimatic Area means

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Data of the monthly means was supplied by Met O 1 for Kew and Eskdalemuir.

Observations at Kew (1953–1972) were complicated by the implementation of the Clean Air Act after 1956. Two turbidity factors (T) were tried; one being the number of years after 1956 up to a maximum of 8, the other up to a maximum of 16. The second factor showed the higher partial correlation in a double regression of radiation (in mw-hr per sq.cm.), R, on sunshine (hours per day), S, and turbidity, T.

Equations in the form $R = aS + bT + c$, and correlations were:-

Kew	Month	a	b	c	Correlations		
					Total	Partial S	Partial T
	January	13.75	0.53	32.3	0.85	0.84	0.63
	February	20.1	0.73	56.3	0.94	0.93	0.59
	March	32.45	1.06	80.4	0.97	0.97	0.57
	April	31.9	0.82	154.3	0.90	0.90	0.27
	May	36.55	0.96	191.7	0.90	0.90	0.31
	June	32.95	2.25	234.0	0.94	0.93	0.54
	July	30.7	1.9	232.6	0.94	0.94	0.55
	August	32.35	0.73	176.9	0.95	0.95	0.32
	September	31.65	1.11	114.8	0.94	0.94	0.47
	October	20.5	0.91	83.1	0.97	0.97	0.76
	November	12.95	0.76	46.1	0.89	0.80	0.61
	December	13.3	0.43	25.2	0.90	0.89	0.59

Data for Eskdalemuir were available for the period 1959–1972, although sunshine monthly means for the earlier years are subject to recheck. The single regressions were as follows:-

Eskdalemuir	Month	a_1	c_1	Correlation
	January	17.65	24.0	0.82
	February	27.3	49.2	0.93
	March	38.9	78.6	0.91
	April	38.5	146.8	0.95
	May	39.05	203.2	0.97
	June	32.4	269.0	0.96
	July	40.75	211.5	0.95
	August	35.2	186.3	0.95
	September	32.75	125.5	0.96
	October	24.05	68.9	0.94
	November	12.1	42.8	0.89
	December	13.75	18.3	0.95

Agroclimatic Area Means

These equations for Kew ($51\frac{1}{2}$ N) and Eskdalemuir ($55\frac{1}{2}$ N) are clearly capable of refinement, nevertheless they are unlikely to be very inaccurate in the middle of a sunshine range. They therefore may be used by applying the Agroclimatic Area sunshine averages to obtain areal radiation averages, interpolating linearly through the latitudes the values for a_r and c_r and taking, in the Kew formulae, T=16 throughout and adding it to the c_r factor before interpolation with c_1 (the Eskdalemuir constant).
It is thought that these averages may be up to 3% low in areas with very little smoke or dust, and correspondingly lower near large towns or cities.
Results are given in the Appendix.

A similar analysis was carried out on Lerwick data, 1959–1972, with the following results.

Lerwick	Month	a_2	c_2	Correlation
	January	15.3	12.75	0.94
	February	22.6	35.9	0.95
	March	33.85	74.4	0.68
	April	36.9	149.2	0.96
	May	37.0	224.4	0.91
	June	34.4	286.0	0.87
	July	36.7	257.5	0.89
	August	32.0	199.3	0.92
	September	30.75	112.8	0.91
	October	14.1	70.3	0.72
	November	10.75	24.5	0.73
	December	11.1	9.95	0.88

Any comments or suggestions on this paper should be referred to the author.

Meteorological Office
Bracknell

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Areal Averages of Total Radiation on a horizontal surface (milliwatt-hours per square centimetre)

Area	J	F	M	A	My	Ju	Jy	A	S	O	N	D
1N	50	120	210	340	425	465	430	360	265	140	65	40
1S	50	120	210	335	415	465	425	335	260	140	65	40
2	45	110	190	315	410	450	395	325	230	130	60	30
3	50	115	215	355	425	480	425	355	250	140	70	40
4	50	105	195	320	410	450	400	335	240	135	65	35
5	50	115	205	325	420	465	415	345	265	145	70	40
6	45	100	190	300	410	445	390	330	235	130	60	35
7	50	110	205	330	425	470	425	350	265	145	65	40
8	50	115	205	335	430	485	430	360	265	145	70	40
9	55	120	225	350	455	500	445	375	270	150	75	45
10	50	100	190	305	410	460	405	335	240	140	65	35
11	50	110	200	320	415	465	420	345	250	145	70	40
12	55	110	200	325	425	475	425	350	260	145	70	40
13	55	110	205	330	430	475	435	360	265	150	70	40
14	55	115	215	335	425	490	430	350	255	150	75	45
15W	55	110	200	320	415	480	420	345	250	145	70	45
15E	55	110	205	320	420	475	425	345	250	145	75	45
16	55	115	205	325	430	480	430	355	260	150	75	40
17W	60	120	215	345	445	490	445	370	265	155	75	45
17E	60	115	220	340	445	490	445	370	265	155	75	45
18N	60	120	210	335	430	490	435	360	260	150	75	50
18S	60	115	215	330	425	490	430	355	260	150	75	50
19	55	110	210	325	420	485	425	350	260	150	75	45
20	55	110	210	325	420	485	425	355	265	155	75	45
21	60	115	215	330	430	485	440	360	270	160	80	50
22W	55	115	210	325	425	485	430	360	270	155	75	45
22E	60	120	210	330	440	485	440	370	275	160	75	45
23	60	115	220	350	450	500	455	375	280	165	80	50
24	60	115	225	350	455	500	455	375	280	165	80	50
25N	65	115	220	335	430	490	440	360	270	155	80	50
25S	65	115	215	340	430	495	445	365	270	165	85	50
26	65	115	215	340	430	495	445	365	270	160	80	50
27	60	115	215	335	435	495	450	365	270	160	80	50
28	60	115	220	335	445	500	450	370	280	160	80	50
29	65	115	220	350	450	505	460	380	285	165	80	50
30	65	115	215	335	435	500	445	365	270	165	85	50
31N	65	120	215	340	435	500	450	370	275	165	85	50
31S	65	120	215	345	445	500	450	375	285	165	90	55
32	65	115	220	335	435	505	455	380	280	165	85	50
33W	65	115	215	335	435	500	455	375	280	165	85	50
33E	65	120	220	340	440	510	465	385	285	170	85	50
34	65	120	225	350	460	520	470	390	290	175	85	55
35	65	120	230	345	440	500	455	380	270	165	85	55
36	65	120	225	345	445	500	450	375	280	165	90	55
37N	65	120	225	345	460	510	465	380	290	175	85	55
37S	70	120	230	360	480	540	480	395	305	180	90	60
38N	65	115	225	340	455	515	470	385	290	175	90	55
38S	70	120	230	360	480	540	480	395	305	180	90	60
39W	65	115	225	345	450	510	465	385	290	180	85	55
39E	70	120	225	355	470	530	475	395	300	180	90	55
40	70	125	235	360	465	520	465	390	290	180	95	60
41	65	120	230	345	440	500	450	370	275	170	90	55
42	70	125	230	345	450	505	455	380	285	170	90	60

Areal Averages of Total Radiation on a horizontal surface (milliwatt-hours per square centimetre) (Cont'd)

Area	J	F	M	A	My	Ju	Jy	A	S	O	N	D
43N	60	115	215	330	425	490	440	355	255	160	85	55
43S	70	125	230	350	450	510	460	375	280	175	90	60
44	65	120	225	345	435	495	450	365	275	165	85	50
45W	70	125	225	350	455	510	470	385	285	170	90	60
45E	70	125	230	350	450	505	460	385	290	170	90	60
46	70	125	230	355	465	520	475	400	295	180	95	60
IOW	75	130	240	370	475	555	490	410	310	185	95	60
47	60	125	240	365	470	510	450	385	275	160	80	50
48N	50	105	205	315	405	460	405	335	240	140	70	40
48S	55	110	210	320	410	465	420	345	250	145	75	45
49N	60	110	210	325	410	470	415	345	245	145	75	45
49S	60	110	210	325	405	475	410	340	245	145	75	45
50	65	120	225	345	445	505	440	365	270	160	80	50
51	60	110	210	330	420	485	430	355	260	155	80	45
52	65	120	220	340	435	500	445	365	270	165	85	50